

# Metrics & Measurement

Introduction to Collecting Data

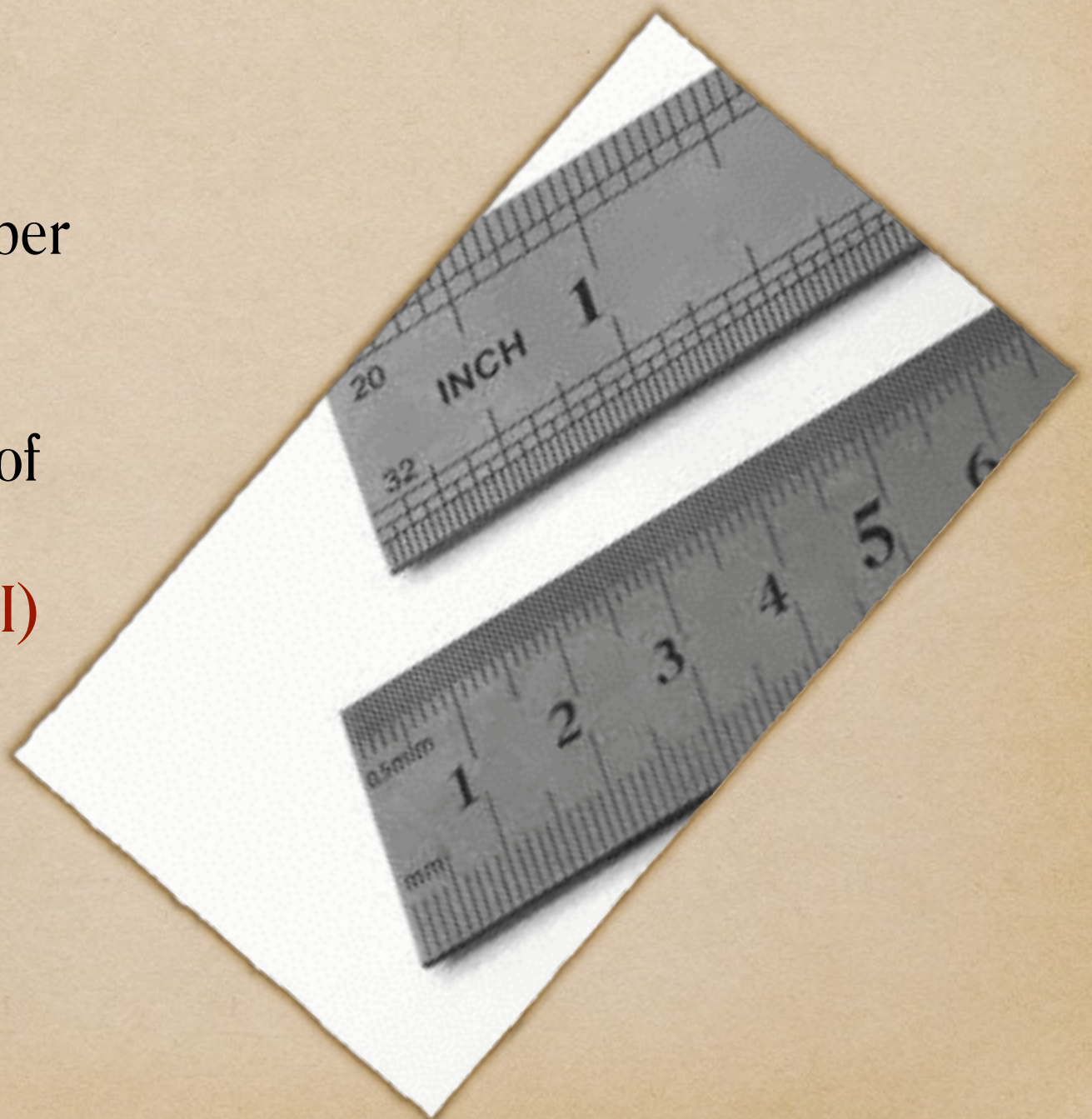


# International System of Units

The **metric system** is a measurement based on the number 10.

Modern scientists use a version of the metric system called the **International System of Units (SI)**

Using SI allows scientists to compare and communicate with each other.





# Common Prefixes

Prefix	Symbol	Meaning
kilo	k	1,000
hecto	h	100
deca	da	10
deci	d	.1
centi	c	.01
milli	m	.001

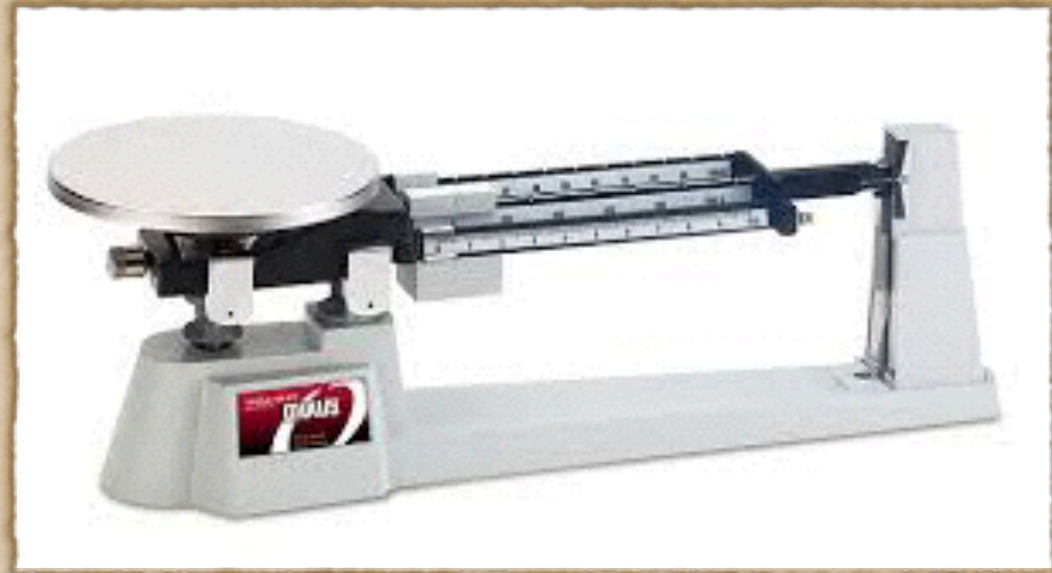


# Measuring Mass

**Mass** is a measure of the amount of matter an object contains. We measure mass using grams (g).

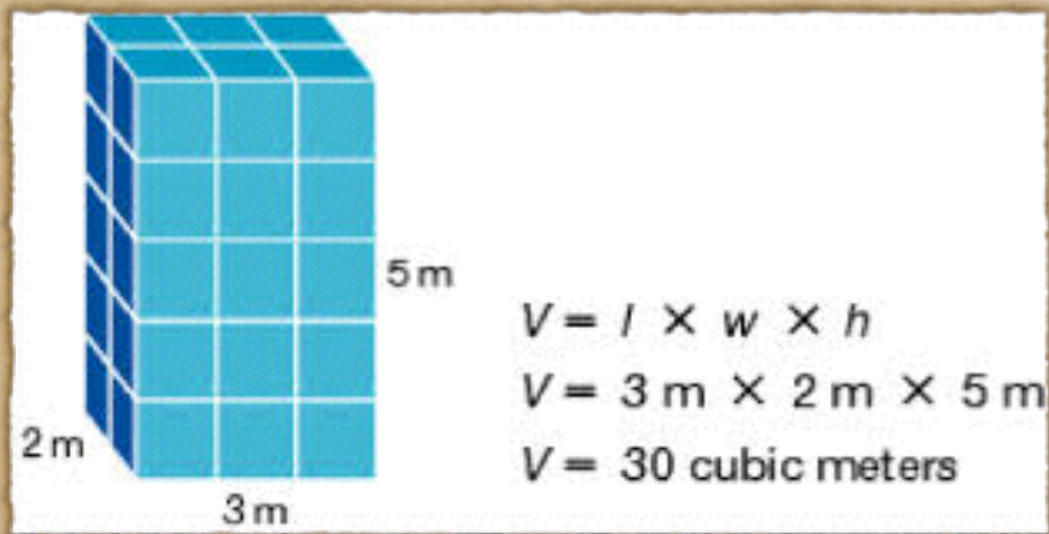
**Weight** is the force of gravity on an object and is not the same as mass.

To find mass, we use a balance.





# Measuring Volume



**Volume** is the amount of space an object takes up. We measure volume using liters (l).

To measure volume, we use a graduated cylinder. To find the volume of rectangular objects, use this formula: **Volume = length X width X height.**



There is a different method to find the volume of irregular objects.

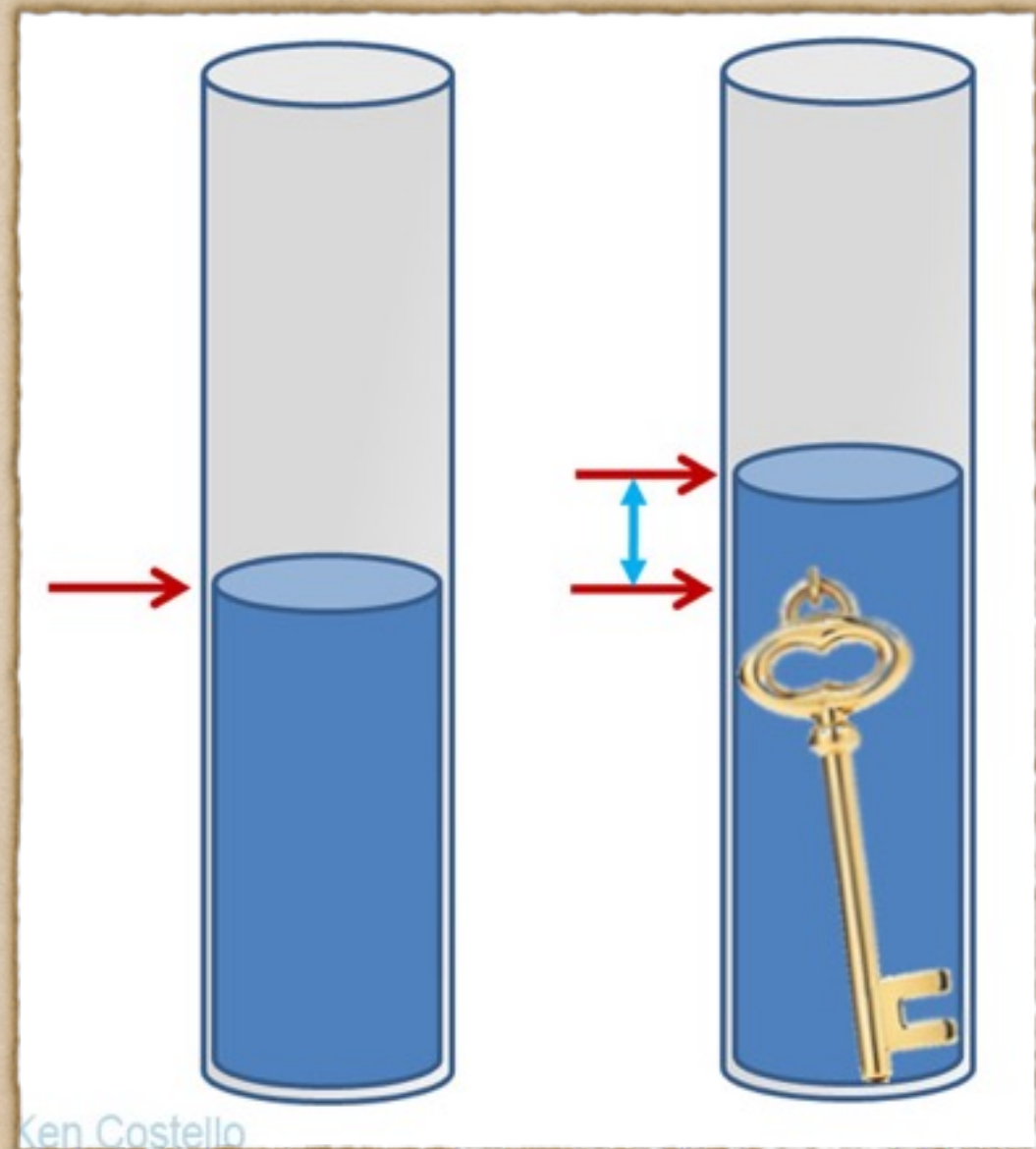


# Volume of Irregular Objects

Volume is a measure of the amount of space an object takes up. When a cylinder is submerged in the water it pushes water out of the way.

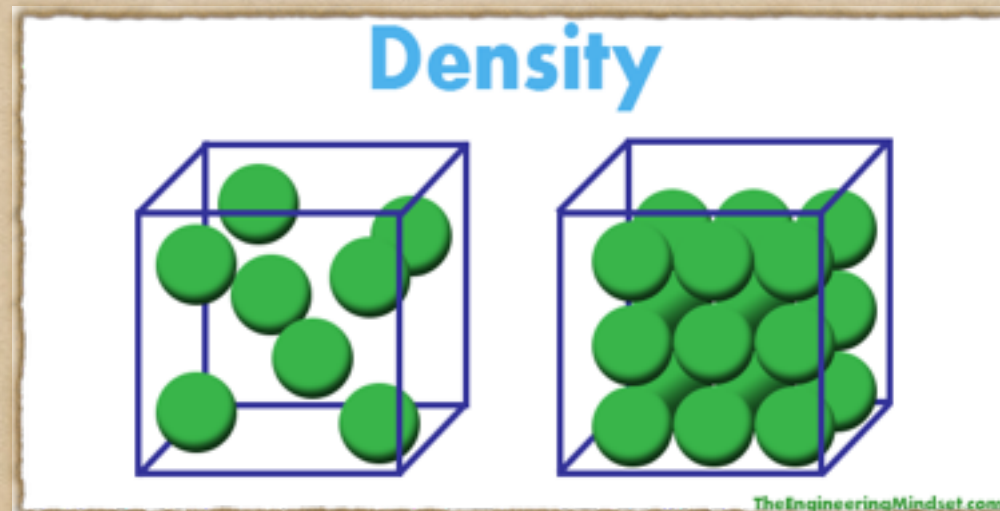
If you measure the amount the water level increases, you can find the volume of the water pushed out of the way.

This is called the **Displacement Method** for measuring the volume of an irregular object.





# Measuring Density



**Density** is a measure of how much mass is in a given volume. We measure density using grams per cubic centimeter ( $\text{g/cm}^3$ ).

To calculate density, use the following formula: **Density = mass/volume**. The density of a substance is the same for all samples of that substance.

If you know an object's density, then you will know if it will float in a given liquid. An object will float if it is less dense than the surrounding liquid.

Substance	Density
Air	0.0010
Ice	0.9
Water	1
Aluminum	2.7

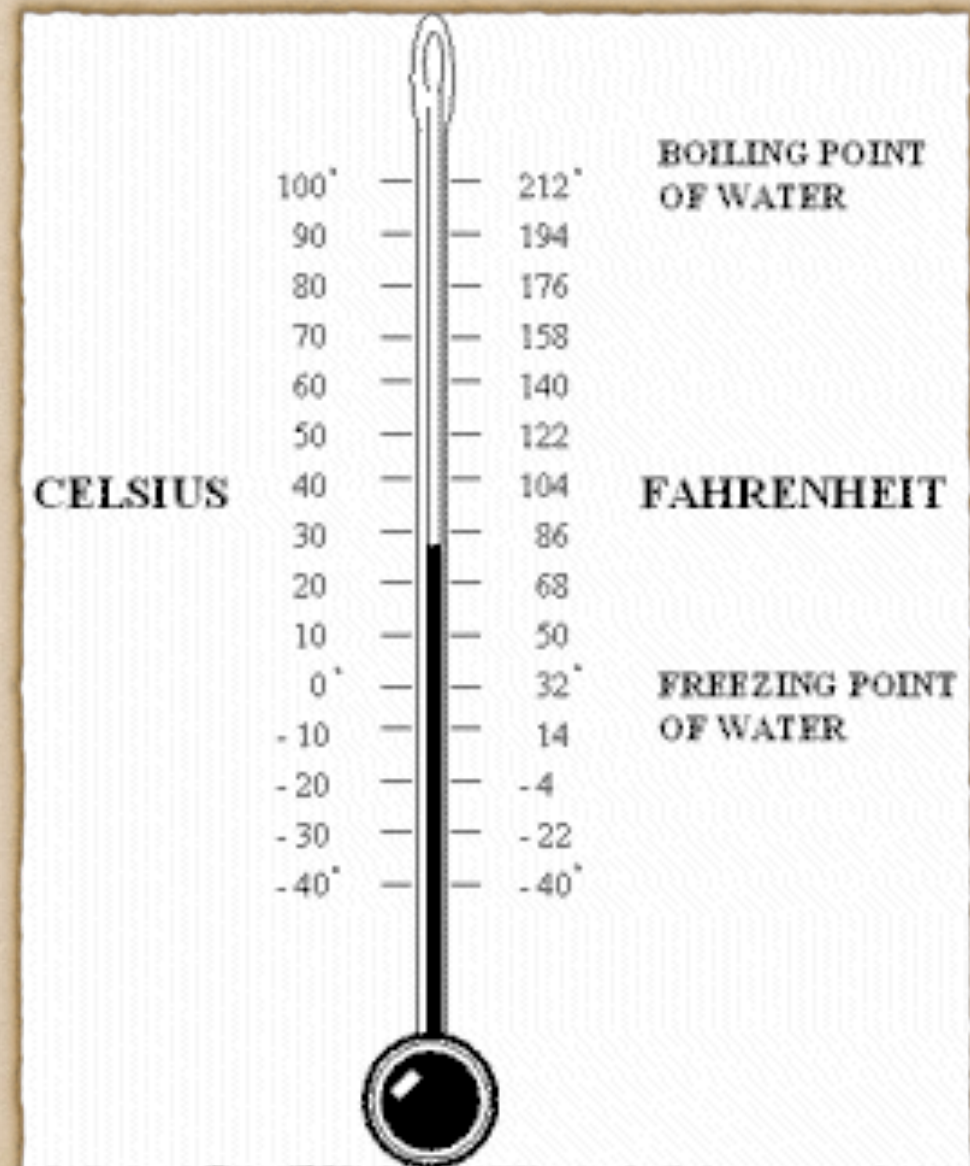


# Measuring Temperature

Scientists commonly use the Celsius Temperature scale (C).

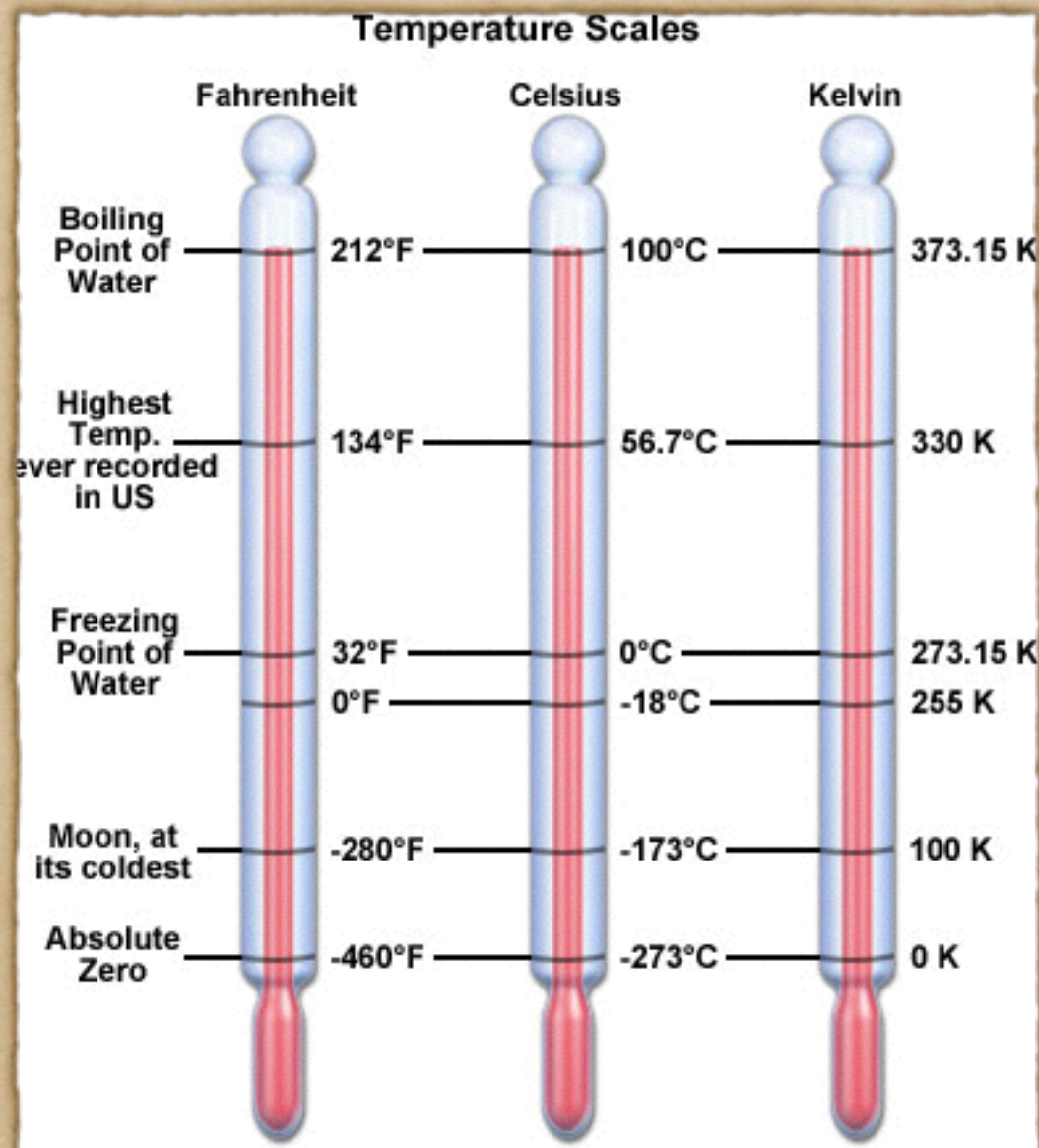
On the Celsius scale, water freezes at 0 and boils at 100. Normal body temperature is 37 C.

There is a different temperature scale that is used in science as well.





# Kelvin Temperature Scale



**Kelvin** (K) is the official SI unit for temperature. Units on the kelvin scale are the same size as for Celsius.

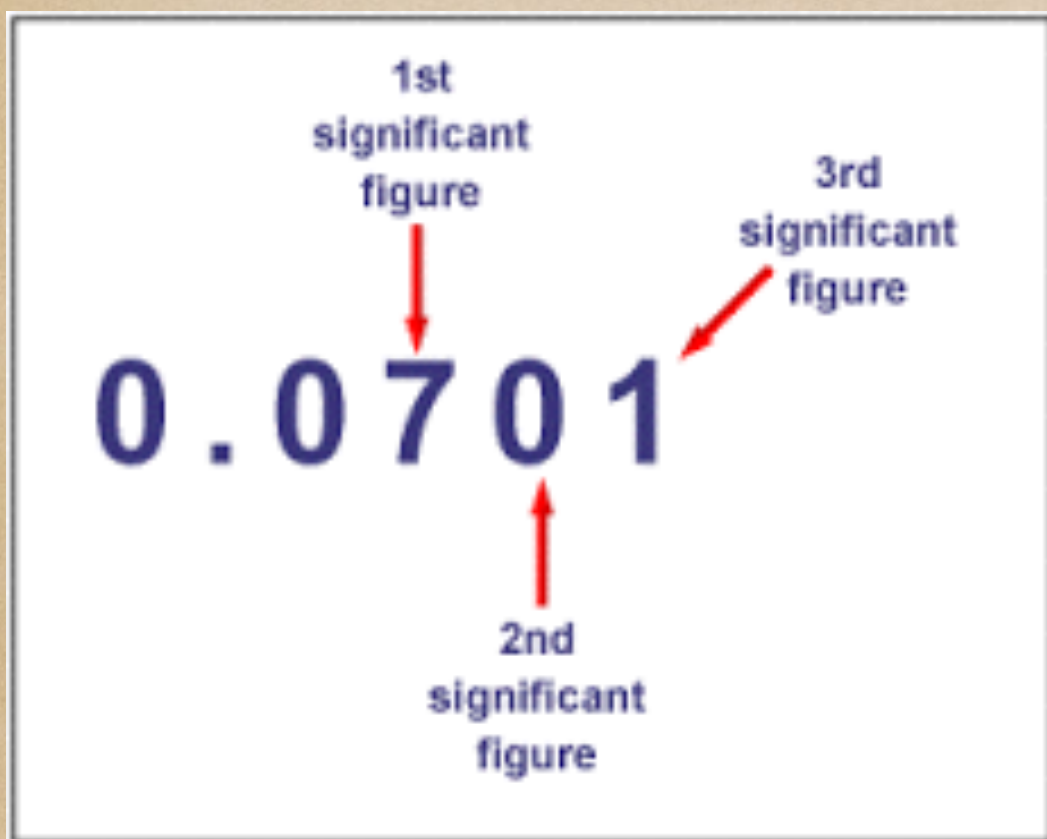
0 on the kelvin scale is considered the coldest possible temperature, this is **absolute zero**.

In Celsius, this is -273 degrees. Kelvin has no negative numbers.



# Significant Figures

There are two kinds of digits you will see in science. Exact numbers are known to be absolutely correct and are obtained by counting or by definition. Measured numbers involve estimation.



Significant digits are numbers believed to be correct by the person making and recording a measurement.

To count the number of significant digits, we follow 2 rules:

- if the digit is not a zero, it is significant.
- if the digit is a zero, it is significant if:
  - it is a sandwiched zero

or

- it terminates a number containing a decimal place. Exact numbers are known to be absolutely correct and are obtained by counting or by definition.



# Keywords (English - Spanish)

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Mass - Masa

Metric System - Sistema métrico

Weight - Peso

International System of Units  
Sistema Internacional de Unidades

Volume - Volumen

Displacement Method  
Método de desplazamiento

Density - Densidad

Absolute Zero  
Cero absoluto

Kelvin - Kelvin